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A Cross-sectional Exploration of Excessive Daytime Sleepiness, Depression and Musculoskeletal Pain among Migrant Farmworkers

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Abstract

In this study the authors estimated the prevalence of elevated daytime sleepiness, depressive symptoms, and musculoskeletal pain among Latino migrant farmworkers, and examined the relationship among these symptoms. Data are from a cross-sectional survey of migrant farmworkers (300) conducted in eastern North Carolina in 2009.

Results—Eleven percent of Latino farmworkers reported elevated levels of daytime sleepiness, 28% reported elevated levels of depressive symptoms, and 5% reported moderate to severe musculoskeletal pain on a daily or weekly basis. Depressive symptoms and daytime sleepiness were positively associated. Depression and daytime sleepiness may increase risk of injury; further research regarding sleep issues is warranted.

Keywords

Depression; Excessive Daytime Sleepiness; Musculoskeletal; migrant; farmworkers; Latino

INTRODUCTION

Sleep disorders, depression, and musculoskeletal pain often appear as a cluster of symptoms. The presence and potential co-occurrence of these symptoms have a particular significance among the farmworker population. In addition to placing individuals at increased likelihood of developing multiple health conditions, farmworkers with sleep disorders, depression, or musculoskeletal pain may have an increased risk of experiencing workplace injuries.^{1,2} Working with toxic pesticides, handling sharp farm implements, and frequent bending and lifting heavy loads provide multiple opportunities for injuries to occur. Concern regarding

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the prevalence and association between daytime sleepiness (with excessive levels of daytime sleepiness being a symptom of multiple sleep disorders), depressive symptoms, and musculoskeletal pain among the farmworker population is therefore warranted.

Latino migrant and seasonal farmworkers live and labor under conditions that can lead to excessive daytime sleepiness, depression, and musculoskeletal pain. Farmworkers experience long hours and low pay³ and report elevated levels of injuries and illness compared to the U.S. workforce as a whole.^{3,4} Their work often involves bending, twisting, and lifting heavy items, activities that can lead to pain and injury.⁵ Use of pesticides in the fields, at times with limited training, exposes them to toxins that can result in acute and chronic pesticide poisoning and has been associated with multiple negative effects, including depression.^{6–8} Their housing is often crowded, of poor quality,^{3,9} and lacking in privacy.^{3,10} Migrant farmworkers frequently lack access to adequate health care, which may exacerbate dental and health problems.^{6,11–15}

Sleep disorders, which can lead to elevated daytime sleepiness, are often associated with depression.^{16–19} Depressed individuals are more likely than nondepressed individuals to have elevated daytime sleepiness levels.^{20,21} Sleep disorders are a central component of depression, and the presence of sleep disorders places an individual at risk of developing depression.^{22,23}

Information about the prevalence of sleep disorders and associated symptoms, including excessive daytime sleepiness, among Latinos in general,^{24,25} and Latino farmworkers more specifically, is scant. Researchers have noted that approximately 20% of Latino farmworkers in Starr County, Texas experienced fairly bad or very bad sleep quality.²⁶ They also found that Latino migrant farmworkers who indicated that they had experienced poor sleep quality or were depressed were at increased risk of experiencing chronic back pain. Physically strenuous work, such as that performed by farmworkers, has also been associated with increased likelihood of sleep disturbance.²⁷ Crowded living conditions may increase the difficulty of obtaining an adequate and uninterrupted stretch of sleep.

Elevated levels of depressive symptoms have been documented among Latino farmworkers in different regions of the country, ranging from approximately 20% in California²⁸ to 25% to 40% in North Carolina,^{29,30} and 40% in the Midwest.^{31,32} Poor working conditions are associated with depression among Latino migrant workers in North Carolina.³⁰ Extended separation from family members, the remote location of many farming camps, and low levels of fluency in English contribute to physical and social isolation.³³

Agricultural workers experience high levels of musculoskeletal pain. Fifteen percent of farmworkers nationwide reported that they had experienced musculoskeletal pain during the previous 12 months, the percentage increasing to nearly 20% among those who had performed agricultural work for at least 10 years.¹⁴ More than 20% of Latino farmworker adults in Texas reported chronic back pain,²⁶ and 45% of male and 75% of female Latino vineyard workers in Oregon reported experiencing musculoskeletal pain in at least one region of their body.³⁴ Those engaged in farming activities have an increased risk of developing osteoarthritis, back pain, and knee, hand, and wrist disorders.^{5,35}

Research on other populations indicates that sleep disorders, elevated levels of depressive symptoms, and musculoskeletal pain each appear to contribute to the risk of experiencing one or both of the other symptoms.^{16,36–38} Physical illness and musculoskeletal pain can mimic or exacerbate depression. Furthermore, depression may delay recovery from musculoskeletal injuries, and pain may extend the time period during which one experiences depressive symptoms.³⁹

Research that examines the association between sleep disorders, depression, and musculoskeletal pain in farmworkers is scant. This paper addresses this gap by (1) describing levels of daytime sleepiness, depressive symptoms, and musculoskeletal pain, and (2) determining empirical overlap among measures of sleepiness, musculoskeletal pain, and depressive symptoms, and (3) identifying risk factors for each health-related problem among Latino farmworkers in North Carolina.

MATERIALS AND METHODS

Data are from a cross-sectional survey of migrant farmworkers conducted in eastern North Carolina June through August, 2009. The farmworkers recruited for the study worked primarily, but not exclusively with tobacco. Primary work tasks included topping, and picking tobacco. The study protocol was reviewed and approved by the Wake Forest University Health Sciences Institutional Review Board.

Participant Recruitment

Participant recruitment and selection involved two steps: (1) sites or camps were identified and selected, and (2) workers within camps were identified and selected. Farmworker camps were located in three eastern North Carolina counties, using an approach similar to that used by Arcury and colleagues.⁴⁰ A list of camps was provided by the North Carolina Farmworkers Project (Benson, NC). Camps were selected and visited in a random order from this list. The randomization process was computer-assisted.

A census was completed at the selected camps in which farmworkers provided preliminary consent to participate in the study. Latino farmworkers at each camp were recruited from the census list; no more than 6 were recruited at each camp to obtain a representative sample of farmworkers from numerous camps in the region. The overall sample size included 300 farmworkers recruited from 52 camps. Farmworkers at 62 camps were asked to participate in the study; participation was declined at eight camps and access was denied by growers at two camps. At the 52 camps included in the sample, 157 individuals refused to participate, for a participation rate of 66%. Informed consent was provided by all participants.

Data Collection

Data collection included an interviewer-administered questionnaire. Questionnaire items addressed participant demographic and background characteristics, presence of depressive symptoms during the previous week, estimates of daytime sleepiness in actual or hypothetical situations during the previous month, and the extent of musculoskeletal discomfort or pain experienced during the current season. The questionnaire was developed in English and translated into Spanish by a native Spanish speaker familiar with Mexican Spanish farmworker vocabulary. The questionnaire was pretested and modified based on feedback from farmworkers.

Measures

The analysis is based on three sets of indicators derived from the questionnaire data that measure body discomfort and pain, depressive symptoms, and levels of daytime sleepiness. Personal characteristics of the farmworkers were also recorded. Daytime sleepiness was measured with the Epworth Sleepiness Scale (ESS), a validated tool^{41,42} that has been used in some nonclinical studies^{43–47} and numerous clinical studies.^{20,21,48–50} Participants reported how likely is it that they had or would have dozed off when or if they had been in 8 distinct situations, including “watching TV” or “sitting and talking with someone” during the past month. Responses could range from “never” (0) to there being a “high chance of dozing” (3). To be considered in the ESS scale a participant had to answer a minimum of

five of the eight questions. For each participant who answered the minimum number of questions, the values from each of the responses were summed, the maximum potential value being 24. Participants whose ESS score was ≥ 10 were considered to have elevated daytime sleepiness levels.^{20,51}

Depression was measured using the Boston \times 4 short form of the Center for Epidemiological Studies – Depressive Symptoms (CES-D), a 10-item form that has been demonstrated to have good predictive accuracy⁵² and appropriate for use among Latino immigrants.⁵³ For each of the 10 items, participants were asked how often they felt or behaved in a particular way during the previous week: rarely or none of the time (0) to most or all of the time (3). The participants' responses were summed, and the maximum value for the CES-D 10 item index was 30. If any of the 10 items were missing the CES-D value was set to missing. Participants with CES-D scores ≥ 10 were considered to have elevated levels of depressive symptoms.⁵³

Participants reported if they had experienced discomfort or pain as a result of their job in eight distinct body parts (neck, shoulders, elbows, wrists, hands, lower back, knees, and ankles) during the current agricultural season using a series of questions and a scoring system adapted from the NIOSH Body Discomfort Interview Guide.⁵⁴ For each body part, the frequency of pain was recorded, 0 indicating no experience of work-related discomfort or pain, 4 indicating daily discomfort or pain. A value of 1 in the version used in this study indicates that the participant reported he or she had experienced pain or discomfort at least once a month during the current season; a value of 1 in the NIOSH Guide indicates pain or discomfort within the past year at the participant's current job. Those who reported work-related pain in a particular body part were asked to rate the severity of the pain. The values in our questionnaire ranged from no pain (0) to unbearable (4). The NIOSH Guide did not indicate a value for "no pain." The values associated with other levels of pain were identical in the NIOSH version and the version fielded. The maximum value associated with any one body part for the individual was the value assigned to the participant. The value of the frequency of pain (0–4) was multiplied by the value of the severity of pain (0–4) for each body part. Participants with frequent moderate or severe pain in one body part therefore had a higher pain scale value than those who reported infrequent or mild musculoskeletal pain in many body parts. Participants who experienced pain on a daily or weekly basis in one or more body parts and reported moderate, severe, or unbearable pain in the same body part(s) were considered to have elevated musculoskeletal pain.

Personal characteristics of study participants were included in this analysis. Farmworkers were asked whether they spoke English, Spanish, an indigenous language, or any other language. Years spent working in agriculture in the U.S. includes the year in which the respondent was interviewed. Age, gender, and educational attainment of the participants were recorded as well.

Statistical Methods

Descriptive statistics were examined in the entire sample for farmworker characteristics of interest (gender, age, educational attainment, seasons in U.S. agriculture, and language). Descriptive statistics as well as the inter-correlations were also examined for the primary outcome variables of depression, musculoskeletal pain and daytime sleepiness. A generalized estimating equation (GEE) approach that allows adjustment of camp clustering was used to further understand the bivariate association between elevated levels of depression, daytime sleepiness, and musculoskeletal pain versus non-elevated levels in farmworker characteristics. These data analyses were performed using SAS 9.2 (SAS Institute, Cary, NC) and p-values of $\leq .05$ were considered statistically significant.

RESULTS

Ninety-five percent of the sample of 300 adult farmworkers was male (Table 1). Approximately 31% of the workers were younger than 30 years old, 37% were between the ages of 30 and 39, and 32% were age 40 or older. The typical Latino farmworker had limited formal education, as over half of the participants had six years of education or less. Almost all Latino farmworkers spoke Spanish; 12% spoke English, and 20% spoke an indigenous language. Approximately 14% had been farmworkers in the U.S. for one year or less; 47% reported that they had worked in U.S. agriculture for 2 to 7 years, and 39% reported 8 or more years.

The mean ESS score was 5.10 (± 3.25). Eleven percent of the Latino farmworkers reported elevated sleepiness, as determined by an ESS score of ten or greater. The mean value of the 10-item short form of the CES-D was 7.89 (± 3.22). Twenty-eight percent of the farmworkers had elevated levels of depressive symptoms, as represented by a score of 10 or more on the short version of the CES-D (Table 3). The mean value of the musculoskeletal pain scale was 1.35 (± 2.09). Five percent of the farmworkers reported elevated musculoskeletal pain, indicating that they experienced weekly or daily pain that was moderate to unbearable in at least one body part during the current growing season.

Age, gender, and years in U.S. agriculture affected the prevalence of one or more conditions. Increased age was significantly associated with increased daytime sleepiness and elevated depressive symptoms. Prevalence of excessive daytime sleepiness was particularly elevated among those aged 40 and older. Women were significantly more likely than men to report elevated musculoskeletal pain, but not elevated depressive levels or elevated daytime sleepiness. A greater number of years in U.S. agriculture was significantly associated with elevated levels of daytime sleepiness, but not with elevated depressive symptoms or musculoskeletal pain. Years in U.S. agriculture was no longer significantly associated with elevated levels of daytime sleepiness when age was controlled (analysis not shown). Neither educational attainment nor language spoken had a significant association with the prevalence of any of the symptoms noted.

The level of daytime sleepiness was significantly and positively associated with depressive symptoms (0.27 at $p < .001$). The musculoskeletal pain value in Table 2 represents the frequency-intensity value associated with the body part reported as having the greatest level of discomfort or pain. The level of daytime sleepiness was significantly and negatively correlated with musculoskeletal pain, although the strength of the association was weak (-0.15 at $p < 0.01$).

DISCUSSION

This study reports the level of three symptoms among Latino farmworkers in North Carolina. To the best of our knowledge, this is the first report to examine the ESS level among a Latino farmworker population. Eleven percent of Latino farmworkers reported excessive daytime sleepiness, as indicated by an ESS score ≥ 10 . Depression is a problem for a substantial number of Latino migrant and seasonal farmworkers; 28% of the Latino farmworkers in eastern North Carolina reported elevated depressive symptoms. Previous studies found that 20% to 40% of Latino farmworkers had elevated levels of depressive symptoms; the findings in this study are consistent with this prior research.^{29,30} Five percent of the Latino farmworkers reported pain that was moderate to severe. This prevalence of pain is less than the levels of 20% to 45% reported in other studies of agricultural workers.^{26,34}

Although our study results for pain prevalence initially appear to be inconsistent those from other studies, it is important to note that the 5% figure represents pain that is of moderate or greater intensity experienced on a weekly to daily basis. Other studies include pain that occurs less frequently or is of lower intensity.^{26,34} Recall periods also vary. All farmworkers in this study, including those interviewed in June, were only asked about pain during the current season. Other studies had a longer recall period,^{14,26} which would be expected to increase reports of pain. The crops worked and tasks performed at different times during the season also influence musculoskeletal disorders.^{4,5} and may therefore affect pain reports during the data collection period of this study and across different studies. Finally, the vulnerability associated with being a Latino migrant farmworker in the U.S. may result in underreporting of injury and associated pain in this and other studies.⁵

The positive association between elevated daytime sleepiness and depressive symptoms is consistent with research of other populations.^{18,20–22,55,56} Cross sectional studies are unable to determine causal ordering;^{34,56} longitudinal research suggests that depression and sleep disorders may each contribute to the presence of the other symptom.³⁶ Having elevated depressive symptoms or a sleep disorder, as assessed by the presence of symptoms associated with a sleep disorder, increases the risk of having or developing the associated condition.

Daytime sleepiness was significantly and negatively associated with musculoskeletal pain, although the association was weak. These findings initially appear to be inconsistent with other studies that report that sleep disorder symptoms are positively associated with pain. These apparently contradictory findings may be due to use of different analytical procedures. The analyses conducted by Shipp and colleagues (2009), and Ohayon (2009) do not address the level of pain symptoms. Castro and Daltro (2008) note the high level of sleeping problems among pain clinic patients, but do not analyze the association between intensity of pain and sleep disorders. Differences in recall period, crops worked and tasks performed may also account for apparent the apparent inconsistency between results of this and other studies.

Depressive symptoms and musculoskeletal pain were not significantly correlated with each other. This initially appears to be inconsistent with studies that have reported an association between back pain and depression among the general populations or agricultural workers.^{26–38} Shipp and colleagues' (2009) and Xiang and colleagues' (1999) studies of farmworkers found a positive association between depression and back pain; the measure of back pain they used included low grade pain. Our findings, in the context of existing research,^{16, 37,38} suggests that although pain and depressive symptoms may be associated with each other at a general level, the level of frequency and intensity of pain in one body part only is not significantly associated with increased levels of depressive symptoms. It should be noted that the report period varies across measures used in this study, ranging from the previous week (CES-D) to the past month (ESS) to the current season (musculoskeletal pain), leading to potential bias. Variation in symptoms across the agricultural season⁵⁷ and inclusion of farmworkers at different times during the season, including fairly early in the season, add further room for potential bias.

Increased age placed Latino farmers at elevated risk of excessive daytime sleepiness and depression, but not musculoskeletal pain. Research on other populations is mixed, with some studies showing a positive association between age and excessive daytime sleepiness.⁵⁸ Other research indicates that increased age is not associated with elevated daytime sleepiness, except among those 75 and older.^{47,56} Researchers have found that older agricultural workers are more likely to report musculoskeletal pain than their younger counterparts,^{14,26,34} findings inconsistent with our results. Intensity of pain was not,

however, included in other researchers analyses and may account for the difference in findings. Consistent with other research on Latino farmworkers, women in our sample were more likely to report pain than men.²⁶ Other associations were not significant, possibly due to the limited statistical power of the analyses.

These findings suggest that it is particularly important to screen and treat older farmworkers for elevated levels of depressive symptoms and elevated daytime sleepiness. Although they may not be at increased risk of experiencing high intensity pain, studies suggest that older agricultural workers are at increased risk of experiencing musculoskeletal pain more generally. Health care providers who diagnosis and treat Latino farmworkers should be alert to the increased risk faced by their female and older patients.

Elevated depressive symptoms, daytime sleepiness, and musculoskeletal pain pose particular health risks to farmworkers who use farm machinery and sharp tools, apply toxic pesticides, and transfer heavy loads. The presence of these conditions may be associated with an increased risk of experiencing workplace injuries.^{1,2} Identification of the three symptoms and treatment for the associated disorders could reduce occupational injuries among the farmworker population. The importance of identifying and effectively treating depression, sleep disorders, and musculoskeletal pain among the Latino farmworker population is therefore crucial.

Knowledge about the prevalence of sleep disorders among Latino farmworkers is limited.²⁶ Multiple measures should be used to evaluate the presence of sleep disorders and their related symptoms, and to determine the effect of individual characteristics on the risk of having a sleep disorder among migrant farmworkers. Additional instruments that could be used include the Pittsburgh Sleep Scale,⁵⁹ Berlin Sleep Apnea Questionnaire,⁶⁰ and the Insomnia Severity Index.⁶¹

Attention should be given to characteristics of farmworker housing that may contribute to or detract from workers' opportunity to obtain adequate sleep, including degree of crowding, temperature, humidity, noise level in the sleeping area, and functions for which the sleeping area is used. Furthermore, the increased level of elevated daytime sleepiness among older farmworkers suggests that researchers should examine whether the effects of housing characteristics on sleep quality may vary by the age of farmworkers.

This research adds to our knowledge about the prevalence of elevated depressive symptoms, excessive daytime sleepiness, musculoskeletal pain, and the relationship between them among Latino farmworkers in North Carolina. There are, however, limitations to the data and analysis. The Latino farmworkers were drawn from three counties in North Carolina, limiting the generalizability of the findings to other regions, and the relatively small sample size limits the statistical power of the analysis. However, the sampling process recruited participants from 52 farmworker camps and restricted the participants from each camp, ensuring that farmworkers from diverse camps and settings were included in the analysis. The response rate of 66%, although lower than preferred, is higher than the mean response rate articles published across diverse academic disciplines.⁶² Finally, although the CES-D, ESS, and musculoskeletal pain questions all rely on self-reports, potentially biasing the responses, use and evaluation of these instruments (or very similar instruments) in multiple studies make them appropriate for this analysis.

A significant percentage of Latino farmworkers reported elevated depressive symptoms and, to a lesser degree, excessive daytime sleepiness. The presence of either condition may increase the risk of workplace injury. Given that the tasks associated with their workplace put them at elevated risk of work injury, further research is needed to estimate the prevalence of

sleep disorders among migrant farmworkers and to examine factors that contribute to sleep disorders, and the resulting daytime sleepiness, among this population.

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Table 1

Participant Characteristics- Farmworkers, Eastern North Carolina, 2009.

	Total Sample N = 300	
	N	%
Gender		
Male	285	95.0
Female	15	5.0
Age		
18 to 24 years	59	19.7
25 to 29 years	35	11.7
30 to 39 years	110	36.7
40 years and older	96	32.0
Educational Attainment		
0 to 6 years	161	53.7
7 or more years	139	46.3
Years in Agriculture in the US		
1 year or less	41	13.7
2 to 7 years	141	47.0
8 or more years	118	39.3
Language Spoken*		
Spanish	299	99.7
English	35	11.7
Indigenous	60	20.0

* Categories are not mutually exclusive

Table 2

Descriptive Statistics and Inter-Correlations of Daytime Sleepiness, Depressive Symptoms, and Musculoskeletal Pain among Farmworkers in Eastern North Carolina, 2009

	N	M	SD	1	2	3
Daytime Sleepiness (ESS) (1)	300	5.10	3.25	1.00		
Depressive Symptoms (CES-D) (2)	294	7.89	3.22	0.27***	1.00	
Musculoskeletal Pain (3)	300	1.35	2.09	-0.15**	0.09	1.00

**
p < .01

p < .001

Bivariate Associations between Farmworker Characteristics and Daytime Sleepiness, Depressive Symptoms, and Musculoskeletal Pain, Eastern North Carolina, 2009

Table 3

	Elevated Daytime Sleepiness	Non-Elevated Daytime Sleepiness	p- value	Elevated Depressive Symptoms	Non-Elevated Depressive Symptoms	p- value	Elevated Musculoskeletal Pain	Non-Elevated Musculoskeletal Pain	p- value
	(ESS ≥ 10)	(ESS < 10)		(CES-D ≥ 10)	(CES-D < 10)		(≥ Weekly & ≥ Moderate Pain)	(< Weekly of < Moderate Pain)	
	N=32 (10.7%)	N=268 (89.3%)		N = 82 (27.9%)	N = 212 (72.1%)		N = 16 (5.3%)	N = 284 (94.7%)	
	%	%		%	%		%	%	
Gender									
Male	30	255	0.65	79	200	0.41	13	272	0.01
Female	2	13	4.9	3	12	5.7	3	12	4.2
Age									
18 to 24	1	58	0.01	9	50	0.03	2	57	NA
25 to 29	5	30	11.2	11	24	11.3	0	35	12.3
30 to 39	8	102	38.1	29	79	37.3	5	105	37.0
>= 40	18	78	29.1	33	59	27.8	9	87	30.6
Educational Attainment									
0 – 6 years	19	142	0.49	50	108	0.07	11	150	0.29
7+ years	13	126	47.0	32	104	49.1	5	134	47.2
Years in Agriculture									
1 or less	2	39	0.01	10	31	0.92	2	39	0.68
2 – 7 years	10	131	48.9	39	98	46.2	9	132	46.5
8+ years	20	98	36.6	33	83	39.2	5	113	39.8
Language Spoken									
Spanish	31	268	100.0	82	211	99.5	16	283	NA
English	7	28	10.4	12	21	9.9	1	34	0.47
Indigenous	10	50	18.7	13	47	22.2	3	57	0.88

* p-value for association between those who have and do not have elevated depressive level, those who do and do not have elevated daytime sleepiness, and those with elevated and non-elevated musculoskeletal pain, adjusting for camp